# Code

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In communications, a **code** is a rule for converting a piece of information (for example, a letter, word, or phrase) into another form or representation, not necessarily of the same type. In communications and information processing, **encoding** is the process by which information from a source is converted into symbols to be communicated. **Decoding** is the reverse process, converting these code symbols back into information understandable by a receiver.

One reason for coding is to enable communication in places where ordinary spoken or written language is difficult or impossible. For example, a cable code replaces words (e.g., *ship* or *invoice*) into shorter words, allowing the same information to be sent with fewer characters, more quickly, and most important, less expensively. Another example is the use of semaphore flags, where the configuration of flags held by a signaller or the arms of a semaphore tower encodes parts of the message, typically individual letters and numbers. Another person standing a great distance away can interpret the flags and reproduce the words sent.

In the history of cryptography, codes were once common for ensuring the confidentiality of communications, although ciphers are now used instead. See code (cryptography).

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# Codes in communication used for brevity

Code can be used for brevity. When telegraph messages were the state of the art in rapid long distance communication, elaborate commercial codes which encoded complete phrases into single words (commonly five-letter groups) were developed, so that telegraphers became conversant with such "words" as *BYOXO* ("Are you trying to weasel out of our deal?"), *LIOUY* ("Why do you not answer my question?"), *BMULD* ("You're a skunk!"), or *AYYLU* ("Not clearly coded, repeat more clearly."). Code words were chosen for various reasons: length, pronounceability, etc. Meanings were chosen to fit perceived needs: commercial negotiations, military terms for military codes, diplomatic terms for diplomatic codes, any and all of the preceding for espionage codes. Codebooks and codebook publishers proliferated, including one run as a front for the American Black Chamber run by Herbert Yardley between WWI and WWII. The purpose of most of these codes was to save on cable costs. The use of data coding for data compression predates the computer era; an early example is the telegraph Morse code where more frequently-used characters have shorter representations. Techniques such as Huffman coding are now used by computer-based algorithms to compress large data files into a more compact form for storage or transmission.

# An example: the ASCII code

Probably the most widely known data communications code (aka character representation) in use today is ASCII. In one or another (somewhat compatible) version, it is used by nearly all personal computers, terminals, printers, and other communication equipment. Its original version represents 128 characters with seven-bit binary numbers—that is, as a string of seven 1s and 0s. In ASCII a lowercase "a" is always 1100001, an uppercase "A" always 1000001, and

so on. Successors to ASCII have included 8-bit characters (for letters of European languages and such things as card suit symbols), and in fullest flowering have included glyphs from essentially all of the world's writing systems (see Unicode and UTF-8).

# Codes to detect or correct errors

Codes may also be used to represent data in a way more resistant to errors in transmission or storage. Such a "code" is called an error-correcting code, and works by including carefully crafted redundancy with the stored (or transmitted) data. Examples include Hamming codes, Reed–Solomon, Reed–Muller, Bose–Chaudhuri–Hochquenghem, Turbo, Golay, Goppa, Gallager Low-density parity-check codes, and space–time codes. Error detecting codes can be optimised to detect *burst errors*, or *random errors*.

# Codes and acronyms

Acronyms and abbreviations can be considered codes, and in a sense all languages and writing systems are codes for human thought. Occasionally a code word achieves an independent existence (and meaning) while the original equivalent phrase is forgotten or at least no longer has the precise meaning attributed to the code word. For example, '30' was widely used in journalism to mean "end of story", and it is sometimes used in other contexts to signify "the end".

# Gödel code

In mathematics, a Gödel code was the basis for the proof of Gödel's incompleteness theorem. Here, the idea was to map mathematical notation to a natural number (a Gödel number).

# See also

- List of coding terms

United States Government Code: A form of communication used by government personnel to communicate their wishes for kickbacks.

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Category: Encodings

# Signal processing

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(Redirected from Signal Processing)

**Signal processing** is the analysis, interpretation and manipulation of signals. Signals of interest include sound, images, biological signals such as ECG, radar signals, and many others. Processing of such signals includes storage and reconstruction, separation of information from noise (e.g., aircraft identification by radar), compression (e.g., image compression), and feature extraction (e.g., speech-to-text conversion).

## Signal classification

Signals can be either analog or digital, and may come from various sources.

There are various sorts of signal processing, depending on the nature of the signal, as in the following examples.

For analog signals, signal processing may involve the amplification and filtering of audio signals for audio equipment or the modulation and demodulation of signals for telecommunications. For digital signals, signal processing may involve the compression, error checking and error detection of digital signals.

- Analog signal processing—for signals that have not been digitized, as in classical radio, telephone, radar, and television systems
- Digital signal processing—for signals that have been digitized. Processing is done by digital circuits such as ASICs, FPGAs, general-purpose microprocessors or computers, or specialized digital signal processor chips.
- Statistical signal processing—analyzing and extracting information from signals based on their statistical properties
- Audio signal processing—for electrical signals representing sound, such as music
- Speech signal processing—for processing and interpreting spoken words
- Image processing—in digital cameras, computers, and various imaging systems
- Video signal processing—for interpreting moving pictures
- Array processing—for processing signals from arrays of sensors

## Topics in signal processing

- Sampling (signal processing)
- Quantization (signal processing)
- LTI system theory
- Fourier transform
- Wavelet transform

## See also

- Signal (electrical engineering)
- Data acquisition

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